FIG.1A FIG.1B

Forming the (7\*7) reconstructed surface of Si(111)substrate by in-situ thermal annealing process

Performing a nitrogen-plasma nitridation process to the Si (111)substrate to form a single-crystal Si<sub>3</sub>N<sub>4</sub> diffusion-barrier buffer layer thereon

Performing an Al pre-deposition process at low temperature to form an Al pre-deposition atomic layer on the single-crystal Si<sub>3</sub>N<sub>4</sub> diffusion-barrier buffer layer

Performing a thermal annealing process to the Al pre-deposition atomic layer to form a single-crystal AlN monolayer on the single-crystal Si3N4 diffusion-barrier buffer layer

Perfroming an epitaxy growth process of AlN layer to form a single-crystal AlN buffer layer on the single-crystal Si<sub>3</sub>N<sub>4</sub> diffusion-barrier buffer layer

Perfroming an epitaxy growth of GaN layer to form an GaN epilayer on the single-crystal AlN buffer layer

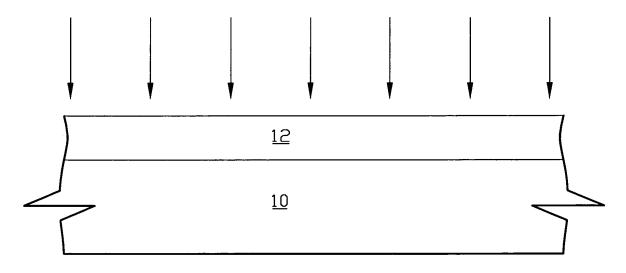


FIG.2A

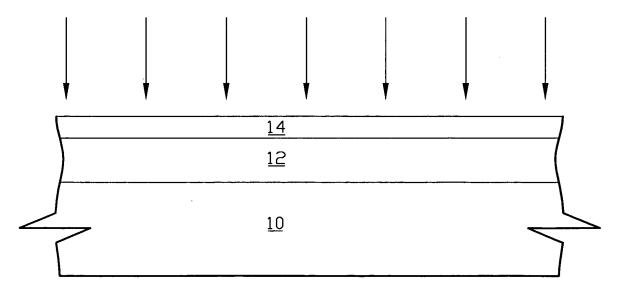


FIG.2B

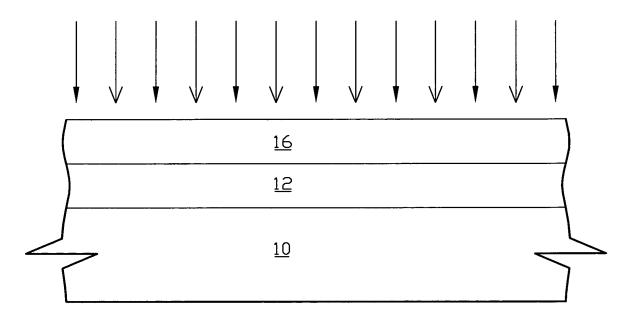


FIG.2C

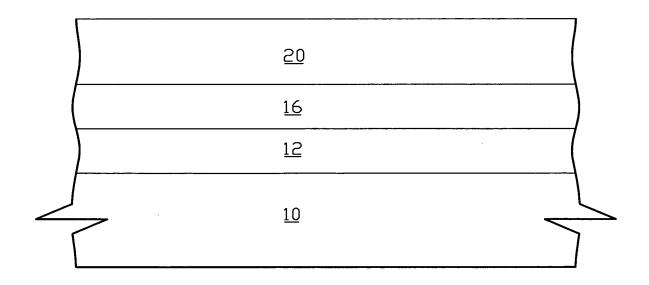


FIG.2D

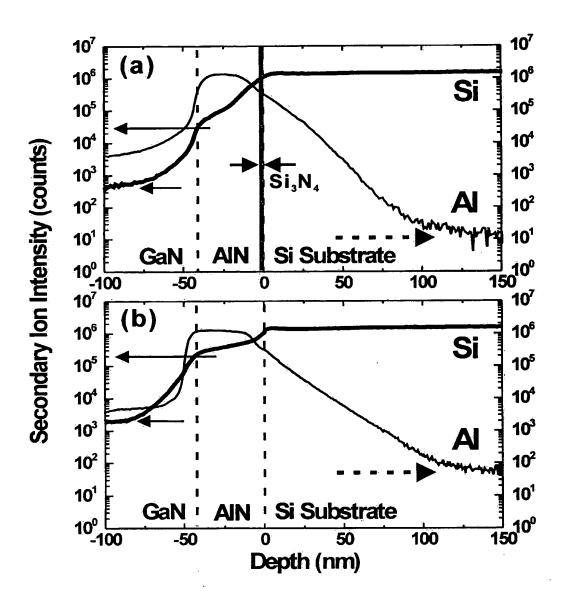
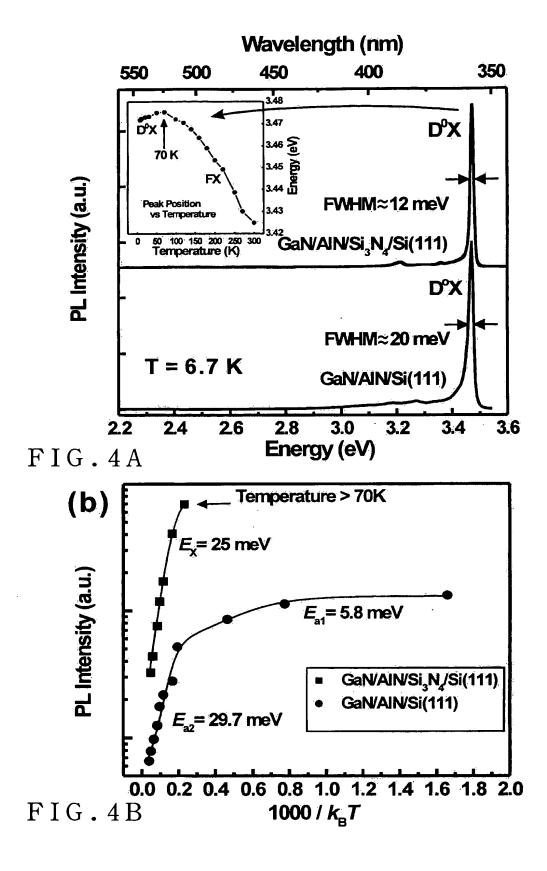


FIG.3



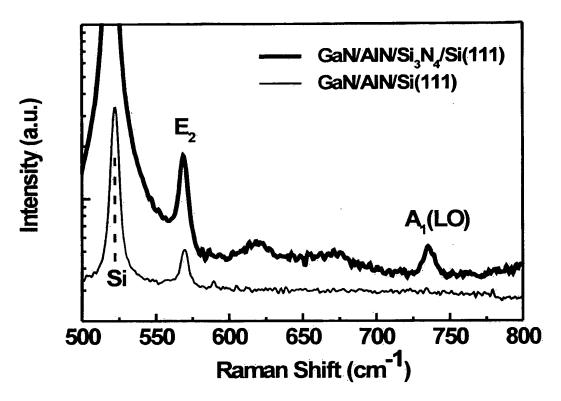


FIG.5